



Updates to the EPA Rating for Hotels

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Agenda

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- EPA Hotel Modeling Results
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- Resort Analysis
- Summary
- Questions and Discussion

EPA Ratings Objective



- Help businesses protect the environment through superior energy efficiency
- Motivate organizations to develop a strategic approach to energy management
- Convey information about energy performance in a simple metric that can be understood by all levels of the organization

EPA Ratings

Technical Foundation



- Analyze national survey data
 - ◆ Commercial Building Energy Consumption Survey (CBECS)
- Develop regression models to predict energy use for specific space types based on operations
- Create scoring lookup table
 - ◆ Ratings are based on the distribution of energy performance across commercial buildings
 - ◆ One point on the ENERGY STAR scale represents one percentile of buildings
- Buildings that perform in the 75th percentile or better can earn the ENERGY STAR label

EPA Ratings Example



- EPA ratings identify the percentile of performance for a hotel's EUI ***when normalizing*** for key operating characteristics in the regression equation
- Two example buildings
 - ◆ Same climate
 - ◆ ***Same EUI***
 - ◆ Different operation
 - Large hotel with many rooms and services vs. smaller hotel
 - ◆ ***Different ratings***

EPA Ratings Example



	Sample Small Hotel	Sample Large Hotel
Square Feet	65,000	750,000
# of Rooms	150	1,000
Presence of Food Preparation	No	Yes
# of Commercial Refrigeration Cases	1	20
# of Workers	15	555
Predicted EUI (kBtu/square foot)	188	248
Actual EUI (kBtu/square foot)	210	210
Rating	31	61

EPA Ratings Example



- Two example buildings have same EUI but different ratings
- Operating characteristics in model account for differences in operation
 - ◆ Commercial refrigeration and/or cooking
 - ◆ Staffing
 - ◆ Number and density of rooms
- These adjustments are based on statistical correlations
- Statistical correlations reflect different levels of amenities and services
 - ◆ **Not** just the kWh requirement of a worker or commercial refrigerator
 - ◆ It is not the worker that uses energy, but the number of workers is correlated with the number of services/amenities

EPA Hotel Modeling Results Model Development



- Multiple factors to evaluate
 - ◆ Regression model statistics (F , p , R^2)
 - ◆ Individual variable statistics (t -stats)
 - ◆ Distribution of ratings
 - By 10% bin
 - Average rating
 - Number and percent above 75
 - Partner Data and CBECS data
 - ◆ Residual and rating plots
 - ◆ Evaluation of your data
 - ◆ Physical understanding of results
 - ◆ Magnitude of impacts
- Final model must show a good balance using all criteria

EPA Hotel Modeling Results

Model Development



- Initial development
 - ◆ Perform a thorough analysis of CBECS
 - ◆ Incorporate many comparative factors
 - ◆ Assess Portfolio Manager and partner data
- Your feedback
 - ◆ Valuable insight into hotel operations
 - ◆ Incorporate observations into model variable decisions
 - ◆ Determined to add optional variables to enable future analyses
 - Did not include servers or in-room refrigerators in model
- Final development/new model
 - ◆ Strong statistical properties
 - ◆ More variables to account for difference in service level and amenities
 - ◆ Robust with respect to CBECS, your data, and Portfolio Manager
 - ◆ Improvement over existing methodologies

EPA Hotel Modeling Results

Model Details



- Data: CBECS 2003 survey
- Dependent variable: Source Energy Use Intensity (kBtu/ft²)
 - ◆ Source EUI
- Independent variables:
 - ◆ Number of rooms per 1,000 square foot
 - ◆ Number of workers per 1,000 square foot
 - ◆ Presence of cooking on-site (yes/no)
 - ◆ Number of commercial refrigeration units per 1,000 square foot
 - ◆ Heating degree days and cooling degree days (HDD and CDD)
 - ◆ Percent heated and percent cooled

EPA Hotel Modeling Results

Model Details



	Coefficient	T Value	Significance
Constant	169.1	22.68	.000
Room Density	33.22	3.560	.001
LN(Worker Density)	20.81	2.004	.047
Food Room	65.14	3.494	.001
Commercial Refrigeration Density	249.8	1.697	.092
HDDxPH	0.0107	3.653	.000
CDDxPC	0.0169	1.988	.049

EPA Hotel Modeling Results

Model Details



- All independent variables are significant with 90% confidence or better
 - ◆ p-level below 0.10
- Model properties
 - ◆ F-statistic: 13.04
 - ◆ p-level: 0.0000
 - ◆ R^2 , EUI: 0.367
 - ◆ R^2 , Source Energy: 0.873
- Strong statistical properties
 - ◆ Improvements over old, existing model

Model Performance CBECS



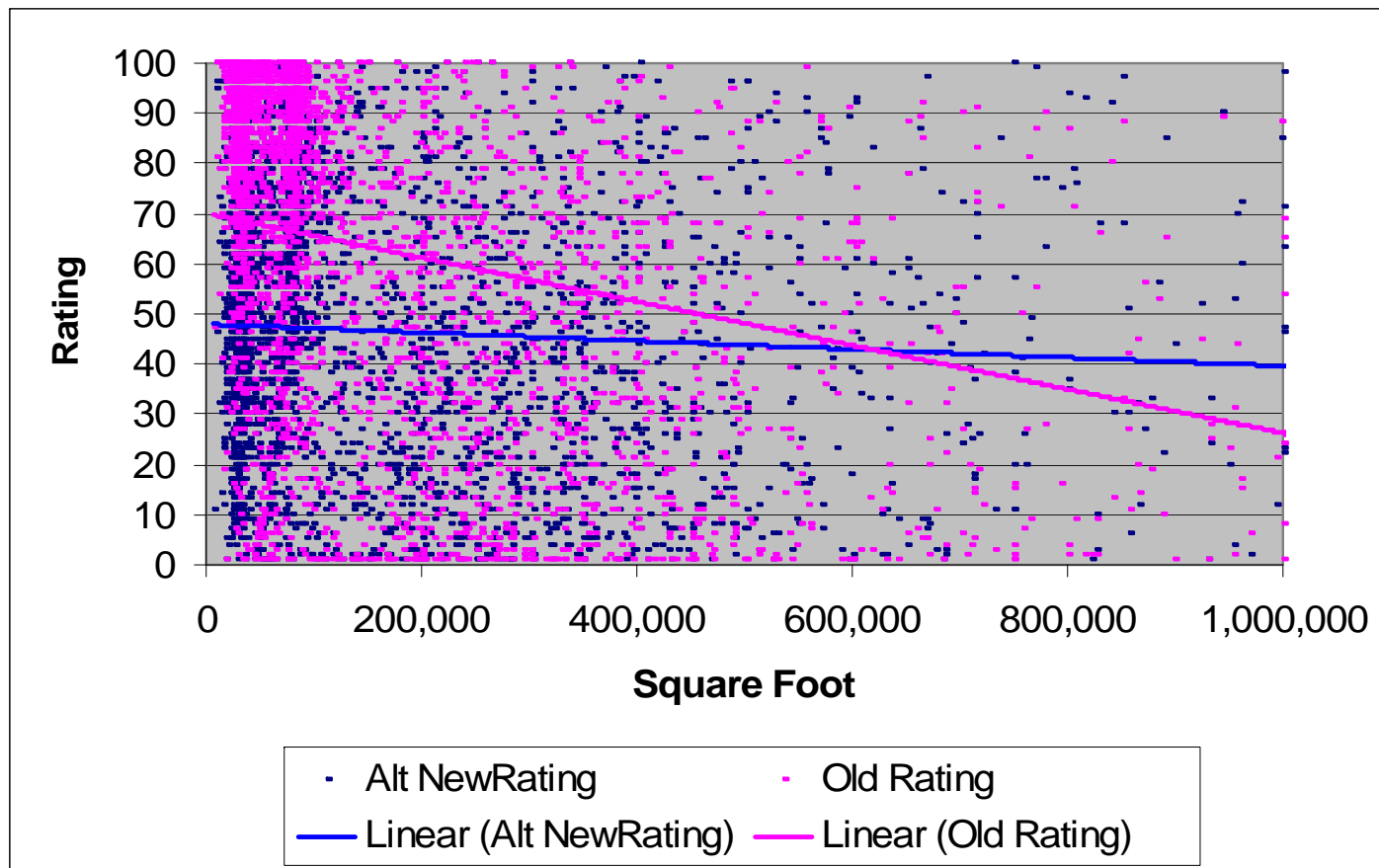
- Model produces a uniform distribution
 - ◆ Approximately 10% of the CBECS population falls within each 10 point rating bin
- Residual plots exhibit random scatter
 - ◆ Buildings with particular operating parameters do not have systematically higher (or lower) ratings
 - ◆ Buildings in different climates do not have systematically higher (or lower) ratings

Model Performance Portfolio Manager

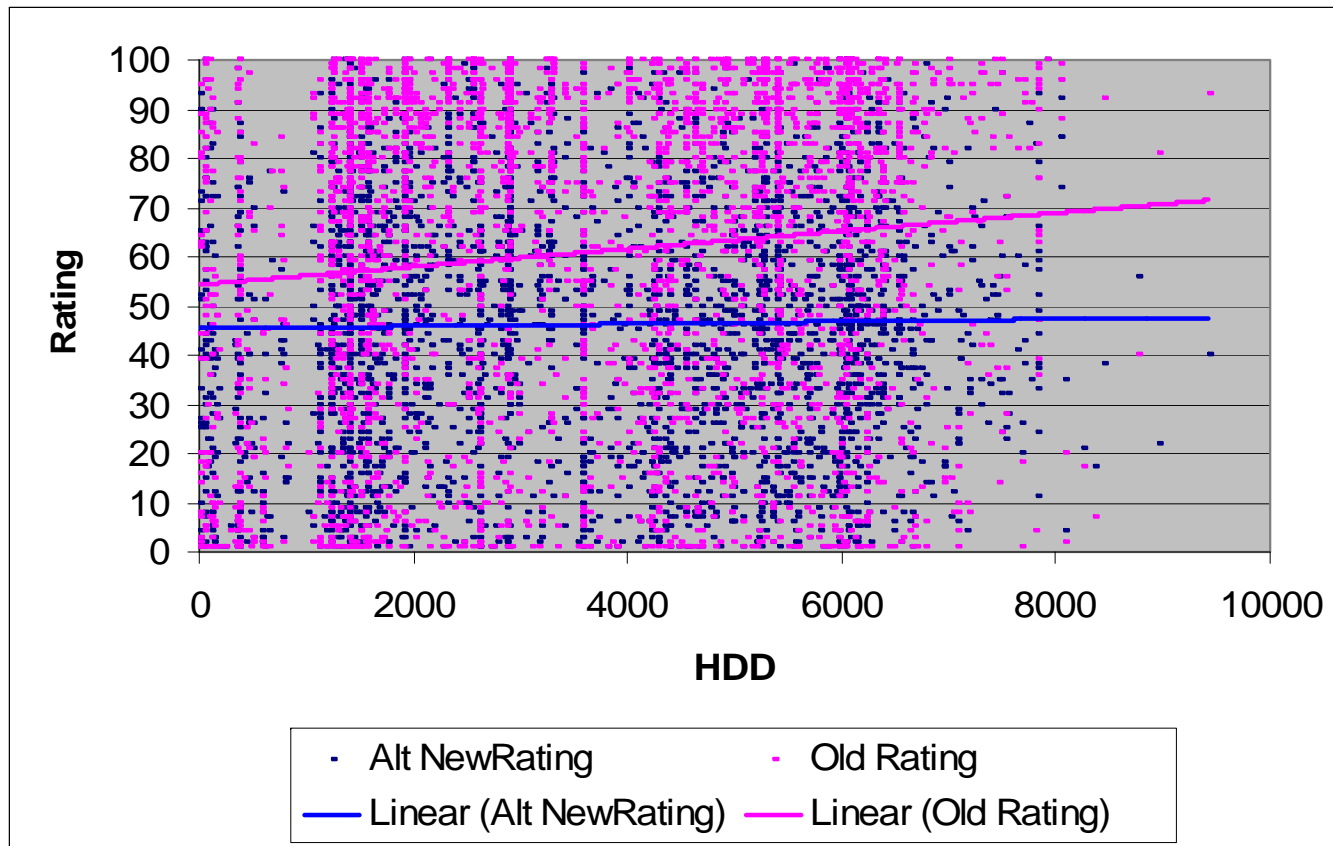


- Model exhibits improved performance across the Portfolio Manager data
 - ◆ More uniform distribution
 - ◆ More equitable ratings across all of the amenity categories
 - Economy tended to rate higher in the old scenarios
 - All show more similar performance (expected) with the new model
 - ◆ Better scatter with respect to key operational parameters
 - Size, climate

Model Performance



Model Performance



Resort Analysis

Profile of Data



- 37 resort properties shared – thank you!
- Not necessarily larger than other hotels you have shared
 - ◆ 23 below 500,000 square foot
 - ◆ Smallest one is under 100,000
 - ◆ Only 14 above 500,000 square foot
- Tend to be in warmer climates
 - ◆ Higher CDD, lower HDD
- Higher EUI (kBtu/ft²)
 - ◆ Portfolio manager average: 241
 - ◆ Average for your 62 properties: 260
 - ◆ Average for resorts: 315
- These are midsize hotels with high energy use
 - ◆ How do they differ from other upscale hotels in Portfolio Manager?

Resort Analysis

Model Performance



- Exhibit a distribution of ratings
 - ◆ Range: 1 to 77
 - ◆ 11% rate above 50
 - ◆ Possible to earn above 75
 - But only a small percent of the population can achieve
- Below average ratings
- Small sample of buildings
 - ◆ 3 companies
 - ◆ 37 hotel properties
- Not clear why ratings are lower
 - ◆ Not all larger
 - ◆ Do not know all amenities
- Still a meaningful distribution
 - ◆ Could be used to track improvement at a facility
 - ◆ Improvement over existing model

Resort Analysis

Next Steps



- Recommend that you use Portfolio Manager to track energy use and improvements
 - ◆ Track energy
 - ◆ Track emissions
- Track rating in Portfolio Manager
 - ◆ Valuable method to evaluate change in performance
 - ◆ Offers normalization relative to typical hotel characteristics
 - ◆ ***Can still earn a label if over 75***
- These buildings do seem to be different from the populations in the old model (PKF/HRG data) and the new model (CBECS data)
 - ◆ Unclear what factors contribute to higher energy use

Resort Analysis

Next Steps



- We would like your input on resorts
 - ◆ More data and analysis will help EPA learn about this group of hotel properties
- What defines this group?
 - ◆ They are not the largest properties
 - ◆ What makes them unique?
 - ◆ What types of amenities do they have?
 - ◆ Is there a better name? Boutique?
- Can we add characteristics to Portfolio Manager to help tracking and future analysis?



Summary

- Model development was successful
 - ◆ CBECS 2003 Analysis
 - ◆ Valuable data and feedback from you
- New model shows strong properties
 - ◆ Equitable performance using CBECS data and Portfolio Manager Data
 - ◆ Improvements over existing model
- Resorts
 - ◆ Do not behave the same as typical hotels
 - ◆ EPA will continue to investigate going forward
- ***New Model Release = February 23, 2009!***



Questions and Discussion

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